ERYTHRASMA - A CLINICAL STUDY

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CERTIFICATE

Certified that this dissertation entitled **"ERYTHRASMA - A CLINICAL STUDY"** is a bonafide work done by **Dr.M.Nandhini,** Post Graduate Student of Department of Dermatology and Leprosy and Institute of STD, Madras Medical College, Chennai - 600 003, during the academic year 2003 - 2006. This work has not previously formed the basis for the award of any degree or diploma.

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CONTENTS

INTRODUCTION

The normal human skin is colonized by huge numbers of bacteria that live harmlessly as commensals on its surface and within its follicles. At times, overgrowth of some of these resident organisms may cause minor disease of skin or its appendages. If the skin is damaged or the immune status of the subject is impaired, bacteria usually regarded nonpathogenic on body surface may assume the role of opportunist pathogens.

Erythrasma is a chronic superficial infection of the skin widely prevalent all over the world. The causative agent is an aerobic diphtheroid called Corynebacterium minutissimum. Extensive work has been carried out by scientists regarding its microbiology, biochemical characters and pathogenicity which has expanded our knowledge about the condition. These organisms contribute to cutaneous ecosystem normally and their behaviour as pathogens requires local or systemic devitalising factors.

REVIEW OF LITERATURE

HISTORICAL ASPECTS

The disease was first described by Burchardt, a German scientist in 1859, who suggested that the delicate filaments and granules found in the scales were of fungal origin and were the cause of the disease[1].

The term `erythrasma' was coined in 1862 by Von Baren Sprung, Burchardts' teacher. He named the causative organism as Microsporum minutissimum.

Most of subsequent workers had no doubt that erythrasma was a separate entity (Kobner 1884; Balzer and Dubrevilh 1883; Unna 1896). Some including Weyl (1884) considered that various transitional forms existed between erythrasma and pityriasis versicolor. Gougerot (1936) recognised the disseminated and subacute forms of erythrasma and pointed out that the condition would be complicated by eczematisation or associated with bacterial or fungal infections. Kobner in 1884 succeeded in reproducing the disease for the first time by applying the scales infected with erythrasma to the skin of one of his pupils[2].

The numerous names under which the causative organism of erythrasma has appeared in the literature includes Microsporum minutissimum, Nocardia minutissima, Sporotrichum minutissimum[3].

In discussing the etiological factors Poehlmann (1928) considered local factors such as site, humidity, body secretions, also individual predisposition, a tendency for

sweating, a delicate integument and systemic illness like diabetes mellitus for the causation of erythrasma.

Robean and Guerra (1936) gave an account of 16 patients with the condition affecting the toe-webs and added that some of the cases had an associated fungal infection.

Nikolowski and Stable (1949) reported erythrasma in unusual sites including a case in which the lesions were confined to the forearms. The generalised form is characterised by well defined scaly lamellated plaques in the trunks and limbs was reported by Goncalves and Mangeon (1960).

The bacterial cause for erythrasma was first suggested by Lagana (1960). However Sarkany, Taplin and Blank (1961) isolated consistently a diphtheroid which they named Corynebacterium minutissimum from the lesions of erythrasma and this had given a new outlook on the condition for subsequent scientists to carry out their work[4]. Now various studies are being carried out relating erythrasma to obesity, diabetes and its association with pityriasis versicolor and dermatophytosis.

EPIDEMIOLOGY OF ERYTHRASMA

The overall incidence of erythrasma is 4%. It is prevalent all over the world. Mild forms of erythrasma of axilla, groins and toe-webs are relatively common in temperate climates; the less common generalised form is predominantly seen in obese subjects particularly in middle aged Negro women.

Incidence is higher in closed communities for example the armed forces and institution. In some institutions, the infection appears to be endemic, the incidence among the patients remaining relatively constant over a period of years. Sarkany, Taplin and Blank in 1962 found that in tropical climates the incidence is higher and generalised form is frequent[5]. The incidence also increases with age, though a case has been recorded in one year old child. This increasing incidence was studied by Laube S (2004)[6].

The incidence of erythrasma does not appear to be greater in males than females, though Board man found toe webs of male students being more commonly affected than those of females.

Erythrasma is not significantly contagious. Holdiness (2003) found that factors such as warm climate, poor hygiene, obesity, hyperhidrosis, advanced age, and diabetes mellitus play a role in the occurrence of the disease[7].

Bowyer A (1971) has shown that erythrasma can be associated with pruritus ani[8]. It has been reported in perianal area of 11% mentally subnormal patients.

Schlappner OL, Rosenblum GA in 1979 reported the association of erythrasma with dermatophytosis of groin[9]. Variable data has been recorded in this regard. Association with pityriasis versicolor has been recorded in groin and axillae[10].

The incidence and severity of the disease is apparently greater amongst diabetics. Somerville and Lancaster in 1973 found that even mild cases of erythrasma were common among diabetics and carriage of fluorescent diphtheroid was greater[11]. It is possible that diabetics are as susceptible to erythrasma as candidiasis and this is perhaps related to the high levels of cutaneous free glucose as shown in a review by Haroon TS (1974)[12]. Montes LF and Dobson H et al have also studied the association of erythrasma and diabetes mellitus in 1969[13]. Schein-feld NS (2004) reported that obesity is a predisposing factor for the development of erythrasma. The use of deodorants does not appear to affect the incidence of erythrasma[14].

NORMAL CUTANEOUS FLORA AND DIPHTHEROIDS[15]

It is important to mention a few words about the normal flora of skin for a better understanding of the disease.

Skin bacteria are found to be of 2 types transients and residents. Transients which are relatively scarce on clean unexposed skin are most abundantly present on exposed skin. The resident flora is a relatively stable population both in size and composition.

The resident aerobic flora consists of Gram positive cocci of Staphylococcus species, Micrococcus species and a variety of Gram positive rods, the coryneforms mainly Corynebacterium spp. and Brevibacterium species. The only significant gram

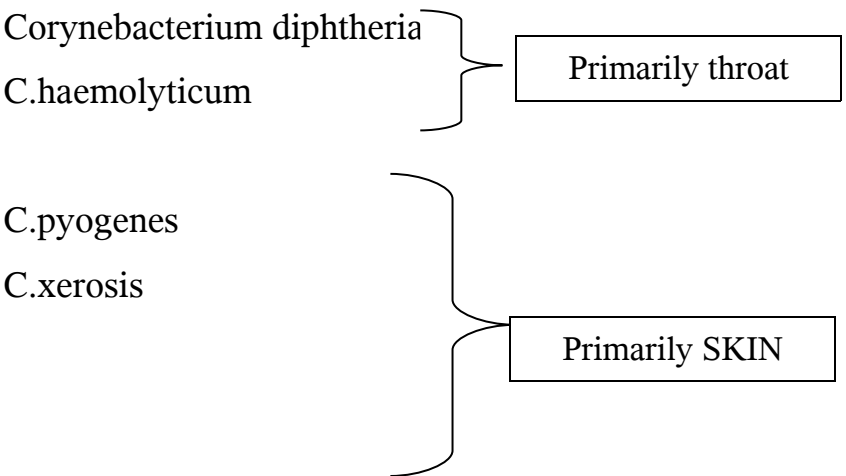
negative residents are Acinetobacter species previously known as Mima and Herellea.

The coryneform (or diphtheroid) organisms are aerobic, Gram positive non-sporing pleomorphic rods. The coryneform bacteria are difficult to separate by conventional taxonomic methods and chemotaxonomic methods. A recently proposed scheme in which the aerobic coryneforms are divided into four corynebacterium species complexes, C.bovis, C.minutissimum, C.xerosus and C.hofmani with Brevibacterium epidermis and Propionibacterium spp. making up a total of six groups.

Cutaneous diphtheroids were assigned to different groups depending initially on their O_2 requirements. The anerobic under the term C.acnes and aerobic diphtheroids according to their origin, lipophilicity and porphyrin production. C.acnes has now been shown to be a propionibacteria which are anerobic Gram positive rods. P.acnes are particularly associated with follicles that have large pilosebaceous glands over face and upper trunk. It is associated with acne lesions in which its role is a matter of considerable interest.

CORYNEFORM BACTERIA

Human commensals or pathogens
Aerobic



C.hofmanii

C.minutissimum

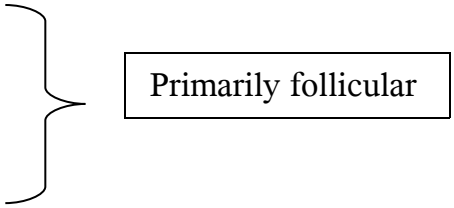
Brevibacterium epidermis

Anerobic

Propionibacterium acnes

P.granulosum

P.avidum



Pathogens of other vertebrates sometimes infecting humans

Listeria monocytogenes

Erysipelothrix rusiopathiae

Aerobic diphtheroids are commonly found in large numbers on the skin especially in adult life. Two characteristics features of these aerobic diphtheroids are lipophilia and porphyrin production.

Sebum is an important source of metabolites for both the aerobic and anerobic diphtheroids. Palmitate is the most common fatty acid formed in human surface lipids and all lipid dependent strains hydrolyse this substance.

Porphyrin production can be demonstrated by examining under UV light, the cultures grown on suitable media when, the typical coral red fluorescence is seen. In 1961, Sarkany, Taplin & Blank detected porphyrin production by the diphtheroid responsible for erythrasma[16]. However this characteristics is more prevalent amongst corynebacteria than expected. In addition to C.minutissimum, C.xerosis, C.bovis,

C.ulcerans, C.renale also show fluorescence. C.diphtheriae is known to produce coproporphyrin III under conditions of iron deficiency and the red fluorescence of the comedones of face has been shown to be due to the production of coproporphyrin III and Protoporphyrin IX by P.acnes.

Somerville in 1973 used nine simple tests (lipophilia, glucose fermentation, nitrate reduction etc) to arrange the aerobic cutaneous diphtheroids into 15 groups seven of which produce porphyrins and eight non porphyrin producers[11].

Phages have been isolated from various species of corynebacteria other than C.diphtheriae. Montes and his colleagues demonstrated by electron microscope an apparent bacteriophage cycle in diphtheroids on human skin.

The aerobic diphtheroids may be isolated from the skin in virtually all parts of the body in most people. They are particularly common in axilla, groin and toe webs. Age plays an important role in determining the incidence of the organisms. In newborn, at first there are relatively few organisms though an increase in number occurs within a matter of few hours. Numbers and incidence increase in childhood but are highest in young adults. It is suggested that with the increase in the amount of sebum secreted on to the skin at puberty, conditions favour the survival and growth of these organisms source of which are lipolytic and some lipophilic. In the axilla diphtheroids with the micrococci contribute to the development of axillary odour.

So much for the role of diphtheroids as normal flora, among which few are involved in etiology of erythrasma, trichomycosis axillaris, pitted keratolysis and acne.

MICROBIOLOGY OF CORYNEBACTERIUM MINUTISSIMUM

C.minutissimum belonging to the aerobic diphtheroids has common morphologic features of diphtheroids. On staining with Gram stain, the isolates from the skin lesion of fluorescent scales of erythrasma show rod like organisms, filaments and coccoid forms. The filaments are tortuous and measure about 4μ to 10μ by 1μ. The longer filaments have segmented or beaded appearance. The bacillary forms are 1μ-3μ long and 0.5μ in diameter. Some of them reveal subterminal granules.

The shorter bacillary forms are more profuse in the erythrasma lesions of toes, however filamentous forms and chains of bacilli are also found[1]. The lesions often contain higher proportion of filaments but invariably also shorter bacillary forms.

Under electron microscope[17] numerous bacteria will be seen at different levels of stratum corneum. Proliferating over the skin surface lying freely between the superficial cornified cells, penetrating these cells from the intercellular space or less frequently, directly from the skin surface and intracellularly within the keratinised cells.

Most of the organisms observed to be on the skin surface are characterised by homogenous fine structures. Bacteria within the stratum corneum are quite pleomorphic. Furthermore, dividing organisms are more common on the surface than within the stratum corneum.

The stratum corneum itself becomes hyperkeratotic with superficial layers widely separated and the cell boundaries disrupted at the sites of bacterial penetration. In the keratinised cells cytoplasmic areas of decreased electronic density frequently are

observed around the intracellular bacteria probably suggesting a keratolytic process.

Electron micrographs of the full stratum corneum thickness have shown that the bacteria in erythrasma can penetrate as deeply as one-half of the thickness of that layers. Bacteriophages apparently exist within the bacterial cell[18].

R.Marks and N.D.Ramnarain (1972) studied erythrasma patients using skin surface biopsy technique[3]. The skin surface biopsies were tested for enzyme histochemical reactions and were also subjected to scanning electron microscope studies.

Skin surface biopsies from the affected sites stained with PAS reagent or Gram stain demonstrated the presence of numerous fusiform microorganisms which are arranged in clusters, chains or singly and scattered over variously sized areas.

The chains that were seen usually comprised three, four or occasionally more, individual bacterial cells. The microorganisms appeared approximately three to four times as long as they were broad.

With PAS stain there was noticeable diffuse staining of the sites containing the micro organisms which was visible macroscopically. There did not appear to be a particular accentuation around hair follicles or sweat gland openings.

The enzyme histochemical studies show that corynebacterium minutissimum possess a wide range of enzyme activities. Mitochondrial enzyme activities seemed particularly strong especially NAD diaphorase and lactic dehydrogenase activities. The

reaction products from the tests performed were not distributed diffusely within the individual bacterial cells but appeared aggregated in well defined foci within each cell.

With the scanning electron microscope single rod shaped and oval structures and chains were seen lying on, and embedded in, the surface of the individual cornified cells. The surface of the bacterial cells appeared regularly smooth. The chain of bacterial cells were frequently seen to be penetrating the cornified cells. At the site of penetration there were, in several scales openings that were two or three times larger than the diameter of the microorganisms.

The involved cells in the stratum corneum had an irregular ridge pattern, mainly composed of low, broken, undulating ridges which sometimes branched. The surrounding uninvolved cells often possessed prominent villi resembling the surface structure of the scale in psoriasis and some other parakeratotic disorders (Dawber, Marks and Swift, 1972).

This skin surface biopsy study showed that there was a remarkable disparity between the numbers of bacteria seen in stained preparations with light microscope and the number seen by scanning electron microscope. This is probably a reflection of the fact that the surface scanned by scanning microscope is five or six cell layers down into stratum corneum, while with the light microscope the whole thickness of the specimen removed is examined.

Montes, Black and McBride (1967) demonstrated by conventional electron microscope that the great majority of the microorganisms of erythrasma did not invade

further than the superficial part of the stratum corneum[19].

The surfaces of the horn cells into which the micro organisms had penetrated possessed a disorganized ridge pattern suggesting a possibility of disruption of the tonofilament desmosome complexes. At the site of penetration the opening was wider than the micro organisms. This suggests that penetration was accomplished by a chemical dissolution rather than by purely physical pressure.

Montes et al. (1967) noted disorganisation of keratin fibrils in horn cells invaded by C.minutissimum.

The enzyme reaction products were aggregated in well defined areas confirming a complex subcellular arrangement akin to mammalian cells. A similar arrangement has been noted with enzyme reactions in the dermatophyte fungi (Meinhof, 1968).

The smooth exterior of the organism observed by scanning electron microscope with only a slight constriction at the site of the junctions between microorganisms in a chain and the PAS reactivity of the microorganisms reflects the secretion of a mucopolysaccharide sheath by the organism in some situations.

Somerville (1972) discussed the microbiology of cutaneous diphtheroids and stated that the diphtheroids responsible for trichomycosis axillaris produced secretions that stick them together and to the hair, and cause, in addition, destruction of the hair keratin. A similar material may well be produced by C.minutissimum[11].

Sarkany, Taplin and Blank devised Tissue Culture Medium 199 for growing the

organisms under specific conditions[4]. This medium consist of 78% tissue culture medium without bicarbonate, 20% fetal bovine serum and 2% agar. The prepared medium is autoclaved for 10 mts at 15 lbs pressure per square inch. Plates are poured by decanting the hot liquid from the coagulated proteins which are discarded. On inoculation at 38^0C the fluorescent scales of erythrasma lesions, within 24-48 hrs, small shiny, round, translucent, colorless, slightly elevated convex colonies appear. There is no pigment production in visible light, but red fluorescence diffusing into the surrounding medium can be observed under Woods light. Some batches of fetal bovine serum have an inhibitory effect on the growth of the organisms. Autoclaving the medium or using a dialysate of fetal bovine serum helps to promote growth and fluorescence. Inhibition of growth also takes places, when autoclaved medium 199 is used with human or horse serum. Certain batches of Tissue Culture Medium 199 are marketed with the addition of antibiotics such as penicillin or streptomycin. Such media suppress the growth of the organisms and are unsuitable. A pink fluorescence in and around the colonies is also seen on sheep blood agar, chocolate agar and yeast extract casein agar, but the fluorescence assumes striking proportions only on the tissue culture medium. Subculture of the organisms grow on a finally large number of bacteriological media. They also thrive on the chorioallantoic membrane of ten day old embryonated eggs at 38^0C.

Gram stain of a smear from a colony shows Gram positive rods which become pleomorphic in older cultures. These organisms contain metachromatic granules and are non-motile, aerobic or microaerophilic, catalase positive, indole negative, non hemolytic. They ferment maltose, fructose, mannose and in some strains sucrose. Dark

field microscopy shows typical bacilli with well rounded ends and a marked thick outer wall.

In vitro sensitivity tests carried out on solid and liquid media show that the organisms are maximally sensitive to erythromycin.

Sarkany and his colleagues applied pure culture to stripped or scarified areas of skin of forearms and kept them occluded for 72 hrs. Scaling and fluorescence occurred in three out of five inoculations. These were of relatively short duration and did not develop into permanent erythrasma. Fluorescent cultures were reobtained from these experimentally induced lesions. Hence Sarkany et al. showed that this organism fulfilled Koch's postulates[1].

The grouping scheme proposed by Somerville shows that any of the seven groups of fluorescent diphtheroid may be isolated from the lesions of erythrasma. Using this grouping scheme Somerville and her colleagues found that in their community, one particular group was more commonly associated with erythrasma than with healthy skin and this represents an endemic strain. The initial isolate described by Sarkany, Taplin and Blank and used as type strain in the National collection of type culture belongs to Group 2[4].

It is clear that fluorescent diphtheroids associated with erythrasma are members of normal skin flora which multiply under certain conditions like chafing and maceration in axilla and groins to become predominant members of the skin flora and eventually produce the characteristic fluorescing lesions of erythrasma. Non fluorescent

diphtheroids also appear in greater members in these lesions rather than on healthy, non scaling, non fluorescing areas. So conditions favour the multiplication of all the skin diphtheroids.

PATHOGENESIS [20,21]

The skin with mucous membrane forms the first line of defense against infection. Both dryness and keratinisation limit proliferation of microorganisms. This is supported by low pH of skin surface. These characteristics also limit its colonisation with commensal organisms.

Microbes that are able to cause infections need to overcome the above defense mechanisms. These get through an intact epidermis either mechanically or by lysing the keratinocytes. Some organisms are continuously on look for an opportunity to get under the epithelium. This occurs when a break usually traumatic occurs in epidermis.

The stratum corneum consists of avital keratin mixed with lipids secreted by different skin glands. The organisms that parasitise on the skin mostly skin commensals use these lipids as substrate for metabolism. Often their presence goes unnoticed but if there is enough substrate available they grow out in numbers, that evoke an inflammatory response of underlying tissue. This results in itching with or without erythema. Because secretory glands of skin have highest concentration in skin folds, such disease originate almost exclusively from one of these, of which erythrasma is one[22].

Thus the causative organism corynebacterium minutissimum which is a commensal outgrows in number due to excessive sweating and maceration and being lipophilic produces lesions predominantly involving flexures.

Corynebacterium species other than C.diphtheriae are known to produce severe

and life threatening infection however, there have been no previous reports of deep tissue invasion by Corynebacterium minutissimum.

Stephen A Berger et al. has studied recurrent breast abscesses caused by Corynebacterium minutissimum in a patient[23]. There was no clinical evidence of erythrasma in the patient but had skin disruptions. Local trauma may have served as the portal of entry leading to invasive infections.

Clinical features

The common sites of involvement are groin, upper thigh scrotum, pubis, axillae, inguinal folds, inframammary areas, toe webs. In toe webs, infection is chronic and most commonly between 4^{th} & 5^{th} toe followed by 3^{rd} and 4^{th} toes[24]. Scaling, fissuring and maceration occur.

Cabo H et al (1983) have described a case of generalised erythrasma in a patient with Type II diabetes[25]. In generalised forms well defined scaly, lamellar plaques in larger areas of trunk, proximal parts of limbs, breast folds may occur. In discoid form[26] of erythrasma circular scaling patches which are easily confused with pityriasis versicolor, pityriasis rotunda and psoriasis. This form is also called tropical erythrasma[27]. A case of disciform erythrasma was presented by Tschen JA and Ramsdell WM in 1983. It was characterised by an atrophic appearing surface and diagnoses was made with help of Wood's light examination and Gram stain.

The lesion of classic form morphologically appear as punctate, well circumscribed, maculopapular lesions. Scales may be greasy or furfuraceous. Older

lesions are associated with fine scaling. The advancing ends are serpiginous. The lesion has no tendency for vascularisation. The color of lesion depends upon i) age of lesion ii) underlying skin pigmentation. It is initially pink color later brown and has no central cleaning. Occasionally vesiculation of lesion was reported by Grigoria and J.Delacretaz in interdigitoplantar type of erythrasma[28]. Vesiculation in the lesions were preceeded by pruritus. According to them, the lesions showed initial vesiculation and erythema followed by large bullae which were initially yellow and later became opalescent. Rarely lesions may become eczematous.

Many of the lesions were asymptomatic and patients seek medical attention for cosmetic disability. Occasionally these lesions are pruritic. Chronicity and recurrence are noted in many cases. Occasional association of erythrasma with pruritus ani was descirbed by A.Bowyer & McColl[8]. The pruritus was longstanding and cure was achieved with erythromycin in such cases.

Toe nails may be involved in erythrasma in the form of subungual hyperkeratosis and onycholysis as reported by Negroni P[29] in 1976. Shelley WB and Shelley ED (1982) studied the corynebacterial triad of coexistent erythrasma, trichomycosis axillaris and pitted keratolysis. They showed that pitted keratolysis caused by Corynebacterium taplin and trichomycosis axillaris caused by Corynebacterium tenuis are associated with erythrasma in few patients[30].

Few systemic infections occurs due to Corynebacterium minutissimum. Guarderas J and A. Karnad (1986) reported Corynebacterium minitissimum bacteremia in a patient with a chronic myeloid leukemia in blast crisis[31]. Embolic retinopathy due to

C.minutissimum endocarditis was reported in 1985 by Brian H.J. and Brucker A.J[32].

In 1984 Stephen A Berger and Alfred Gorea reported recurrent breast abscesses caused by C.minutissimum. The systemic infections that can occur due to C.minutissimum are i) septicemia in neutropenic patients ii) infective endocarditis in valvular heart disease patients iii) post surgical wound infections iv) recurrent abscesses.

INVESTIGATIONS

i) Wood's lamp examination[26]:

Wood's lamp is a high pressure mercury lamp with a special filter that allows the emission of a largely monochromatic UV light with a wavelength of 365 nm. It is especially useful in the diagnosis of certain fungal and bacterial disease and in the assessment of pigmentary disorders.

For examination, the room has to be completely darkened and the patient should be totally undressed. Lesions caused by Microsporum audouinii, M.canis and M.ferrugineum are identified by their blue-green fluorescence. Pityriasis versicolor lesions gives a golden yellow fluorescence. Pseudomonas aeruginosa colonisation gives rise to a blue color.

Hypopigmentation or depigmentation are more easily detected with the aid of Wood's lamp. Urine, stool and red blood cells of patients suspected of having porphyria can be screened with Wood's lamp provoking a characteristic orange-red fluorescence.

In erythrasma the suspected lesions are examined with Wood's light and coral red fluorescence occurs due to a porphyrin production by the bacteria corynebacterium minitissimum. Wigger Alberti N and Elsner P in 1997 did an extensive work on fluorescence with Wood's light and has shown that if the lesions are washed with antibiotic soaps before Wood's lamp examination, fluorescence may be transiently absent[33].

Sometimes fluorescence may persist even after treatment of erythrasma.

Mattox TF and Rutgers J (1993) have described a case of non fluorescent erythrasma of the vulva. It was diagnosed by Gram stain and culture[34].

Other lesions that give pink fluorescence under Wood's lamp examination are.

i. Necrotic tumors
ii. Normal tongue
iii. Follicular openings of face and upper trunk
iv. Acanthosis nigricans of groin and axilla

2. Direct Examination:

a) 10% KOH preparation:

To the scrapings from the lesion 10% KOH solution is added and examined under light microscope. Chains of rods are seen.

b) Gram stain:

The scales from the lesion are scraped and fixed to the slide using egg albumin. Alternatively Padilha (1996) described a single method to stain Malassezia furfur and C.minutissimum in scales collected on scotch tape with lactophenol cotton blue[35].

On staining Gram positive filamentous and coccoid forms were seen.

c) Culture

Culture is difficult and rarely necessary but may be accomplished with a special medium the ideal one being Tissue culture medium 199. Stephen N Cohen and Dorothy Nicholai in 1969 described simple mediums for pigment production by erythrasma diphtheroid[36].

On inoculation at 38^0C the scales of erythrasma lesion, in 24-48 hours smooth small shiny translucent convex colonies appear. These colonies fluoresce under Wood's lamp for upto 4 days. Gram stain of smear from a colony shows Gram positive rods which become pleomorphic in older cultures.

Skin biopsy[37]:

Biopsy of erythrasma lesion often appears normal. It is described as an example of invisible dermatoses. Small coccobacilli may be seen in the superficial layers of stratum corneum. Though difficult to visualise under Hematoxylin and Eosin stain, special stains like Periodic Acid Schiff and Gomoris Methanamine silver stain usually reveal these coccobacilli.

e) Others:

Investigations for underlying factors such as obesity, diabetes mellitus, hypothyroidism are carried out.

DIFFERENTIAL DIAGNOSIS[38]

1. Pityriasis versicolor[39]

The primary lesion is a sharply demarcated macule characterised essentially by fine branny scaling. Typically the eruption shows large confluent areas, scattered oval patches and outlying macules. Most commonly upper trunk is affected and often spreads to upper arms, abdomen, axillae and groins. Under the Wood's lamp, the scaly lesions may show pale yellow fluorescence.

2. Candidal intertrigo

Most cases of cutaneous candidosis occur in skin folds where occlusion by clothing or shoes produce abnormally moist conditions. Typically presents with erythema, cracking and maceration. Lesions have an irregular margin with surrounding satellite papules and pustules. 10% KOH preparation reveals pseudohyphae.

3. Bacterial Intertrigo

It is an inflammatory condition of skin folds characterized by erythema and weeping leading on to maceration and crusting. Pustules and vesicles may herald the infection. Initiating factors include friction, perspiration, maceration or irritation from

stool, urine or topical agents. KOH examination, Gram stain and culture help to identify the organism.

4. Tinea cruris

It manifests as large patches of erythema with central clearing centered on the inguinal creases and extend distally down the medial aspect of the thighs with scaling at the periphery. 10% KOH examination reveals septate branching hyphae with arthrospores. Woods lamp examination is negative unlike erythrasma.

5. Inverse pattern psoriasis

Posriasis is a chronic, relapsing inflammatory skin disorder with a strong genetic basis characterized by circular to oval red plaques over extensor body surfaces and the scalp. Inverse psoriasis is a variant of psoriasis that spares the typical extensor surfaces and affects intertriginous areas with minimal scaling. Skin biopsy confirms the diagnosis.

6. Contact Dermatitis

Allergic and irritant contact dermatitis may mimic erythrasma. Allergic contact dermatitis presents as pruritic papules and vesicles on an erythematous base whereas irritant contact dermatitis manifests as erythema and hyperkeratosis. A bacterial culture and 10% KOH examination are done. Patch testing is done to diagnose contact allergies.

7. Flexural seborrheic dermatitis

Seborrheic dermatitis is a papulosquamous disorder occurring on sebum rich areas of scalp, face, upper trunk characterized by greasy scaling over erythematous skin. The flexural variants are non scaly lesions occurring in axillae, inframammary and inguinal folds, perineum or anogenital crease.

8. Acanthosis nigricans

It is characterised by symmetrical hyperpigmented velvety plaques most commonly on the intertriginous areas of the axillae groin and neck. Skin biopsy helps in the diagnosis.

9. Pityriasis rotunda

Gupta S (2001) reported a case of pityriasis rotunda mimicking erythrasma[40]. Pityriasis rotunda is a rare disease characterized by perfectly round to oval sharply defined, scaly, hypo or hyperpigmented patches over trunk and extremities.

Treatment[41]

The organism involved in this disease are sensitive to many antibiotics. Erythromycin was first suggested for treatment of erythrasma by Sarkany et al. Erythrasma responds to antimicrobials and keratolytic preparations, though toe web infection is particularly difficult to cure.

Erythrasma responds well to topical agents like tolnaftate, 2% sodium fusidate,

Whitfield's ointment, 1 to 2% clotrimazole, miconazole, 10 - 20% aluminium chloride and 2% clindamycin hydrochloride. Ayres and Mehan (1968) achieved clinical clearance and disappearance of red fluorescence after 2- 3 weeks in eight patients treated with tolnaftate with no relapses occurring. Seville and Somerville found that Whitfield's ointment was more or less equally effective. In 1970 Macmillan and Sarkany proved sodium fusidate to be effective particularly in the removal of fluorescent diphtheroids though it was not more effective than Whitfield ointment in producing resolution of clinical lesions clotrimazole and Whitfield's ointment were shown to equally effective by Gaylon and Lonnor B.C in 1973.

Topical erythromycin has not been consistently effective. Topical tolnaftate and clotrimazole lead to resolution of lesions associated with dermatophyte infections. Also topical nadifloxacin and clarithromycin can be used.

Koorshad found that an antibacterial soap was effective in the prophylaxis and control of erythrasma of toe webs in an adult male population. But Somerville, Seville and Noble (1970) found that vigorous use of any soap under trial conditions reduced the incidence of erythrasma, though the antibacterial soaps are more effective and better in reducing the amount of scaling. Benzoyl peroxide or povidone iodine soaps when showering and powders as drying agents are also effective.

Systemic erythromycin in consistently effective in doses of 250 mg qid for 5 days by some and for 10 - 14 days by some others. Holdiness MR (2002) showed that systemic erythromycin when compared with tetracycline has greater efficacy in patients with involvement of axilla and groin[42]. Griseofulvin and penicillin are ineffective.

Wharton JR and Wilson PL (1998) showed that erythrasma can be treated with 1gm single doses of clarithromycin[43].

Prognosis: Excellent, however recurs if predisposing factors are not eliminated.

Prevention: Prevention can be achieved by maintaining good hygiene and healthy body weight, keeping skin dry, wearing clean absorbent clothing and by avoiding excess heat and moisture.

AIMS OF THE STUDY

The aims of the study are

1. To study the age and sex distribution of the patient.

2. To study the clinical profile of erythrasma.

3. To study the predisposing conditions.

4. To study the association of other corynebacterial skin infections and fungal infections.

5. To study the association of other skin disorders.

MATERIALS AND METHODS

60 cases of erythrasma were collected at random from the outpatients of Mycology section, Department of Dermatology, GGH, Chennai over a period of 2 years from Dec 2003 to Dec 2005 for the study.

There was no exclusion criteria and with informed consent the cases were chosen for the study with a clinical diagnosis.

Subsequently careful history was elicited with particular reference to the following:

(i) Age, Sex of patient

(ii) Symptoms and duration of disease.

(iii) Symptoms related to predisposing conditions.

A detailed systemic and dermatological examination were done.

Routine analysis of hemoglobin, urine, blood sugar, serum cholesterol, blood grouping and typing were done in all patients.

In appropriate cases thyroid function tests, ELISA for HIV, USG abdomen and pelvis were done.

The skin lesions erythrasma were subjected to clinical examination and Wood's lamp visualisation.

For Wood's lamp examination the patient was asked to come without having bath. A portable Wood's lamp was used. The patient was undressed in a dark room and the

lesions were examined under Wood's lamp.

The scales from the lesion were collected by scraping. Using egg albumin the scales were fixed on to the slide. The smears were then stained by Gram method and visualised under light microscopy.

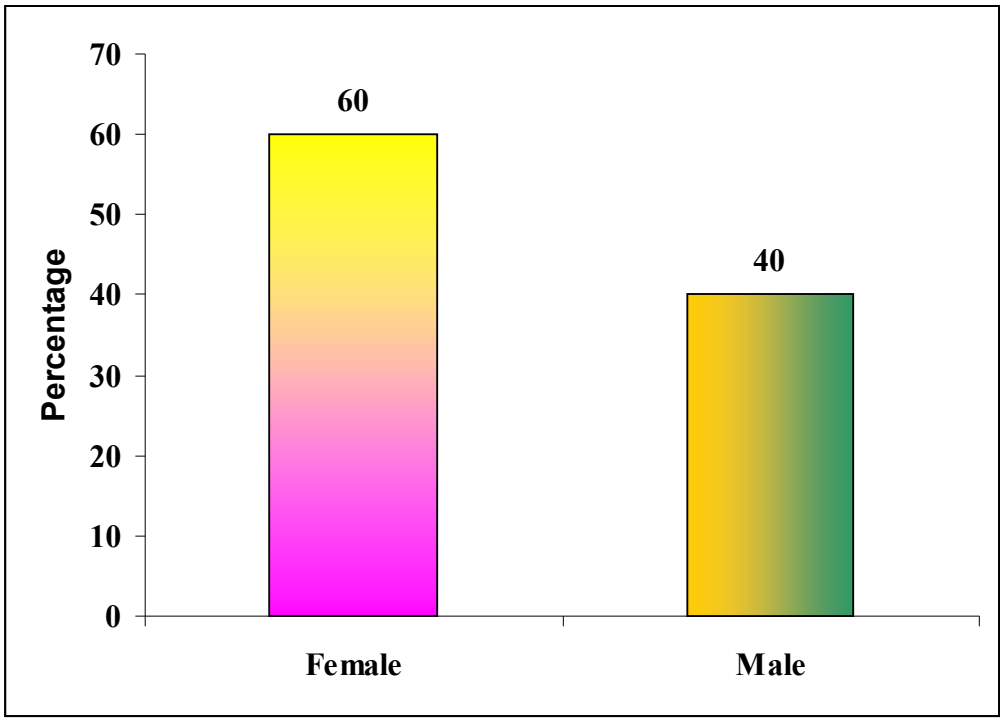
In all cases culture was done. The site of the lesion was thoroughly cleaned and scraping was done. The scales collected were inoculated using a sterile platinum loop into a medium containing Mueller - Hinton Agar enriched with blood. The inoculated plates were incubated at room temperature for 48 hours. After 48 hours the colonies which appeared were subjected to Woods lamp examination and observed for coral red fluorescence.

OBSERVATIONS

Sex distribution

Of the 60 cases of erythrasma studied 24 were males and 36 were females. The incidence of males was 40% and females was 60%.

Following bar diagram shows sex distribution



Age distribution

Age distribution in the study varied from 17 yrs to 70 yrs.

Table - I Age distribution

Age in Years	No.of Cases	Percentage
10 - 20	4	6.7
21 - 30	9	15
31 - 40	12	20
41 - 50	18	30
51 - 60	13	21.6
61 - 70	4	6.7
Total	60	100

30% of cases in the study were between the age of 40 - 50 years.

72% of cases were in the middle age group of 30 - 60 years.

Symptoms

Itching and discoloration of the flexures were the predominant symptoms of erythrasma.

Table - II Symptoms

Symptoms	Number	Percentage
Itching	12	20
Discoloration	21	35
Both	27	45
Total	60	100

45% of patients had presented with both itching and discoloration.

Whereas in 35% the disease was more of a cosmetic compliant with only discoloration and 20% complained of itching alone.

Duration of the disease

In 72% of cases the duration of disease varied between 6 months and 2 years.

Table - III Duration

Duration in years	No.of Cases	Percentage
0 - 0.5	9	15
0.6 - 1	30	50
1.1 - 2	13	21.7
2.1 - 3	5	8.3
3.1 - 4	3	5
4.1 - 5	0	100

The longest duration observed was 4 years and shortest was one month.

There were remissions and relapses in 23 patients. The relapses occured with increase in environmental temperature, sweating and maceration.

Presence of disease in family members

11 out of 60 patients had similar complaints in family members.

Dermatological Lesions

The skin lesions of erythrasma patients studied varied in their morphology as well as distribution and extent of the disease.

Morphology of lesion

The various types of erythrasma lesions observed were macular, maculopapular, lamellar, intertriginous, follicular, eczematous and disciform types.

Table - IV Various morphological patterns observed.

Lesions	No.of Cases
Maculopapular	51
Macular	5
Lamellar	4
Follicular	3
Intertriginous	3
Disciform	1
Eczematous	1

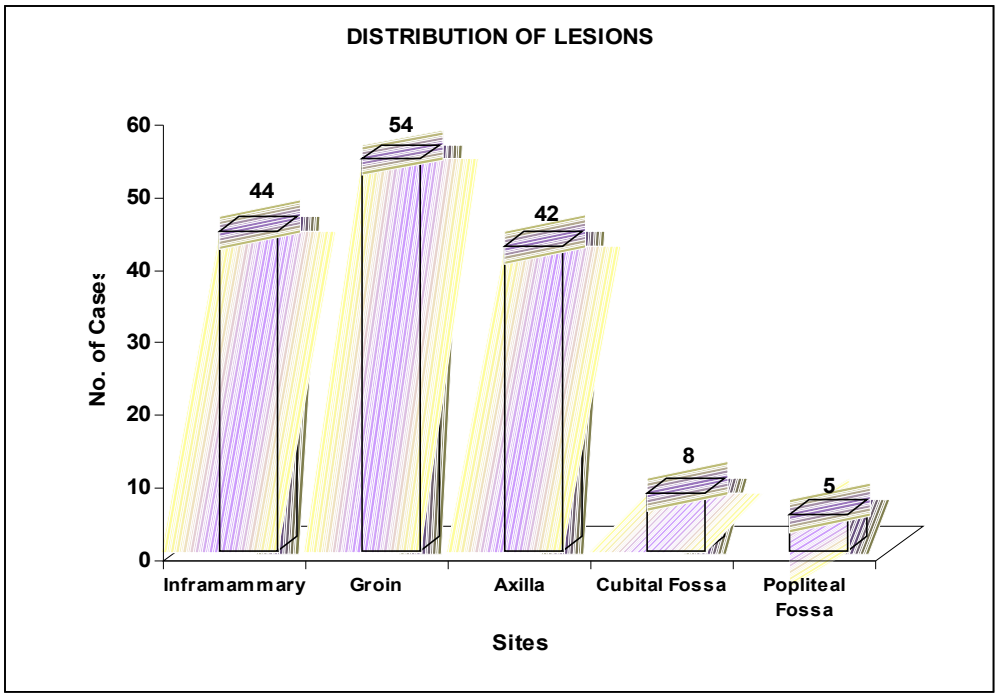
Of these maculopapular (Fig. 1) type was the commonest. Satellite macules (Fig. 2) around larger patches were frequent and characteristic. The lamellar type (Fig. 3) was seen in patients with generalised erythrasma. Intertriginous forms existed alone or along with dermatophytosis and candidiasis. A case of disciform erythrasma was also observed.

Distribution of lesion

Table V The distribution of lesions

Site of Lesion	No.of Cases
Groin	54
Inframammary	44
Axilla	42
Cubital Fossa	8
Popliteal Fossa	5

Groins (Fig. 4) were the most common site to be involved followed by axillae (Fig.5). In both these sites the lesions were bilateral and symmetrical. The scales were dry and brown and not erythematous.



Other sites involved were inframammary regions (Fig.6), abdominal folds, popliteal (Fig.7) and cubital fossa (Fig.8). In few cases the periumbilical area and perianal area (Fig.9) was also involved.

Interestingly the lesions were seen over the left side of neck in female patients (Fig.10) which might be due to the friction and occlusion by the clothes. In a patient undergone colostomy erythrasma occured under the colostomy belt due to occlusion (Fig.11).

Associated dermatological infections

Table VI Associated dermatological infections

Associated infection	No. of cases
Dermatophytosis	14
Candidiasis	11
Pityriasis versicolor	10
Keratolysis punctata	5
Trichomycosis axillaris	2

Dermatophytosis (Fig.6) was the most common fungal infection associated.

Candidiasis (Fig.12) and pityriasis versicolor were next commonly associated.

Other corynebacterial infections like keratolysis punctata (Fig.13) and Trichomycosis axillaris and pubis (Fig.14) were also seen in association with erythrasma.

Associated dermatological disorders

Table VII Dermatological disorders associated

Associated Lesion	Cases	Percentage
Melasma	12	20
Acanthosis Nigricans	11	18
Vitiligo	9	15
Traumatic Fissures	5	8
Ichthyosis	5	8

Acne	4	6
Striae Distensae	4	6
Idiopathic guttate hypomelanosis	3	5
Porokeratosis	1	2

Melasma was the most common association seen in 12 cases (20%). Acanthosis nigricans (Fig.15) was next common seen in 11 cases (18%). It was probably due to obesity or underlying hypothyroidism. Vitiligo (Fig.16) was associated with erythrasma in 9 cases (15%).

Traumatic fissures of feet, ichthyosis, striae distensae (Fig.7) were the other associated disorders. In 3 cases idiopathic guttate hypomelanosis (Fig.17) and in one case porokeratosis were observed.

Associated systemic conditions

Among systemic conditions obesity was commonest occurring in 18 cases (30%). Obesity was simple or associated with diabetes mellitus or hypothyroidism. Next common association was diabetes mellitus which was seen in 15 cases (25%). Hypothyroidism occurred in 12 cases (20%).

Table VIII Systemic associations

Systemic Association	Cases	Percentage
Obesity	18	30
Diabetes Mellitus	15	25
Hypothyroidism	12	20
Hypercholesterolemia	10	16
Rheumatoid Arthritis	2	3
HIV	2	3

Hypercholesterolemia was present in 10 cases (16%) Two patients had rheumatoid arthritis. ELISA was positive in 2 patients one male and one female and both patients presented with generalised erythrasma.

Among the 36 females patients 10 had menstrual disturbances who also had hypothyroidism and obesity. 3 patients had underlying polycystic ovarian syndrome.

INVESTIGATIONS

Complete Hemogram

In 60 cases recorded, anemia was seen in 6 cases leukocytosis was seen in 4 patients.

Blood Sugar : 15 cases showed hyperglycemia which were later confirmed by glucose tolerance test.

Serum Cholesterol : Hypercholesterolemia was observed in 10 cases.

Blood grouping and typing : Most common blood group observed was O +ve followed by A +ve.

Thyroid Function test: Revealed hypothyroid status in 12 cases.

ELISA for HIV : Two cases showed HIV seropositivity by ELISA test.

Wood's Lamp Examination : Portable wood's lamp was used. The patient was advised to come without having bath. Coral red fluorescence (Fig 18) was observed in all except one case.

Gram Stain: The scales were scraped and fixed on to slide using egg albumin and stained by Gram method. Gram positive coccobacilli were seen in all cases (Fig.19).

Skin biopsy

Histologically there was hyperkeratosis with basket weave stratum corneum, acanthosis and papillomatosis. There was increased pigment in the basal cell layer. Sparse inflammatory infiltrate was present in the upper dermis and around blood vessels. The coccobacilli were seen in stratum corneum by GMS stain (Fig.20) and also by H&E method (Fig.21).

Culture

The scales were collected and inoculated into a medium of Mueller Hinton Agar enriched with blood. Small pale grey convex colonies (Fig.22) appeared after 48 hours in only 4 cases out of 60 cases inoculated. Few of the colonies showed coral red fluorescence on Wood's lamp visualisation (Fig.23).

Treatment:

All the cases were treated with T.Erythromycin 250 mg qid for 14 days along with topical application of 2% clotrimazole cream. In many patients there was a good response but recurrences were not prevented unless the predisposing factors were corrected.

DISCUSSION

Sex Distribution

In literature erythrasma was reported to be more common in men by Peter K Lee et al[38]., and equal sex incidence was reported by Gary L Darmstadt et al[27]. In this study there were 36 female and 24 male cases showing that the incidence of erythrasma is more in females than in males. This increased incidence may be due to the obesity commonly observed in females more than forty years.

Age Distribution

The most common age group to be affected were between 40 - 50 years in which one third of cases occured. 43 cases (75%) occured in the 30 - 60 years age group.

The youngest age group observed was 17 yeas and oldest was 70 years.

This correlates with the literature that incidence of erythrasma increase with age as reported by Gary L Darmstadt et al[27] and Laube S[6].

The increased prevalence of metabolic derangements like diabetes mellitus, obesity and hypothyroidism in middle age group might be the reason for the occurrence of erythrasma in them.

Also the presence of lipid in apocrine secretion after puberty may also influence the above finding.

Symptoms

RJ Hay and BM Adrians[15] have reported that in temperate climates the erythrasma lesions were symptomless but in tropics, irritation of lesions occur leading to scratching. Similarly in this study 27 patients (45%) had itching and discoloration of flexures as their predominant complaint. It was asymptomatic in 21 cases (35%) who reported for the cosmetic inconvenience.

The associated candidal intertrigo and increased sweating and maceration in the flexures due to obesity might be the reason for itching in majority of cases.

Duration of disease

It is shown in this study that erythrasma is a chronic disease with remissions and relapses. These remissions were associated with the hot and humid tropical climate due to increased sweating and thereby maceration.

Presence of disease in family members

11 patients (18%) had family members who were also diagnosed as erythrasma. This indicates that the disease is not significantly contagious. The incidence of erythrasma among family members might be related to the common living conditions and similar predisposing factors in families.

Dermatological lesions

In literature the most common type reported was the maculopapular type which was also the commonest in this study. It was seen in 51 patients (85%). In patients with generalised erythrasma lamellar type was seen. One case of disciform type and eczematous type of erythrasma was observed.

Distribution of lesions

In literature by RJ Hay and BM Adrians erythrasma was described to occur most commonly in the groins[15].

In this study also groins were the most common site to be affected followed by axilla bilaterally and symmetrically. All the intertriginous areas were affected.

Apart from intertriginous areas few cases showed involvement of left side of neck due to friction by clothes in females and in one case erythrasma occured under colostomy belt which may be due to occlusion.

The lesions were not erythematous as reported in literature. They were brown to black due to the skin type V prevailing in our population.

Associated dermatological disorders

The coexistence of erythrasma with pitted keratolysis and trichomycosis axillaris was described by Shelley et al[30]. 1982. Concomitant erythrasma and dermatophytosis of groin was reported by Schlappner et al[9]. in 1979. In 2004 Karakatsanis G described coexistence of pityriasis versicolor and erythrasma[10].

The most common skin infections associated with erythrasma in this study were dermatophytosis, candidiasis, pityriasis versicolor, keratolysis punctata and trichomycosis axillaris. The coexistence of the above infections with erythrasma indicates that common predisposing factors of moisture and obesity are involved in these conditions.

The high incidence of melasma and vitiligo and few cases of idiopathic guttate hypomelanosis observed in these cases of erythrasma suggests a possible common factor related to pigmentation is involved in them.

The coexistence of acanthosis nigricans and striae distensae might be due to underlying obesity and hypothyroidism associated with erythrasma.

Associated systemic disorders

The increased frequency of obesity and diabetes in the patients studied concurs with the literature reports of Scheinfeld NS[14] & Haroon TS[12] that erythrasma is commonly associated with both of the conditions.

This may be related to the high levels of cutaneous free glucose occuring in diabetes mellitus. The association of hypercholesterolemia in 10 patients (16%) in the study group suggests that possibly an increase in cutaneous lipid may promote the growth of lipophilic Corynebacterium minutissimum.

10 female patients (35%) in the study had menstrual irregularities and 2 had polycystic ovarian syndrome on ultrasonogram. Hypothyroidism, obesity, polycystic ovarian syndrome may be the underlying cause in them thereby predisposing them to erythrasma.

The association of thyroid disorders, ovarian dysfunction, diabetes, rheumatoid arthritis and vitiligo suggests that a possible autoimmune mechanism may play a role in predisposing them to erythrasma.

Investigations

Anemia was recorded in 6 cases and it indicates that it does not predispose to erythrasma. Leucocytosis was seen in 4 cases. There was no reactive leucocytosis as this bacteria remains mainly in stratum corneum and is usually not invasive.

As in general population, in the study group the most common blood group observed was O+ve followed by A +ve.

The literature states that erythrasma prevalence is not increased in immunosuppressed patients[41]. Similarly only 2 cases were positive for HIV by ELISA in this study.

Wood's lamp and Gram stain smear were the procedures which proved the etiological agent Corynebacterium minutissimum by demonstrating its coproporphyrin production by coral red fluorescence and visualisation of gram positive coccobacilli.

These two tests gave consistently positive results in almost all cases and hence confirmed the diagnosis of erythrasma.

CONCLUSION

The following conclusions were drawn from this study

1. More common in females.
2. Mean age of occurrence was 40 - 50 years.
3. Itching and cosmetic disability were the predominant complaints.
4. Maculopapular form in groins was the most common presentation.
5. The disease was chronic with remissions and relapses related to the tropical climate.
6. Obesity, diabetes, hypothyroidism were the common predisposing conditions.
7. Trichomycosis axillaris and keratolysis punctata were the other corynebacterial infections associated with it.
8. Dermatophytosis and candidiasis were the most common fungal infections associated.
9. Melasma, acanthosis nigricans and vitiligo were the most common skin disorders seen in association.
10. Woods lamp examination and Gram stain were useful procedures to confirm the diagnosis of erythrasma.

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44.

ERYTHRASMA - A CLINICAL STUDY

Name: Address:

Age: Marital Status:

Sex : Occupation :

Case No: Hospital No:

HISTORY

Dark discoloration of flexures: Yes No

Duration : Yes No

Itching: Yes No

Past History

Similar illness: Yes No

DM HT TB RA Others

Family History

Similar illness Partner Parents Children Others

Drug History

Steroids: Yes No

Menstrual History

Menarche:

Periods: Regular Irregular

Menopause:

Pelvic Surgeries: Yes No

EXAMINATION

General Examination

Built: Well Moderate Poor

Height: (m)

Weight: (kg)

BMI:

Anaemia: Yes No

Lymphadenopathy: Yes No

Systemic Examination

CVS RS ABDOMEN CNS

Dermatological Examination

Clinical type of lesion: Macular Papular Intertriginous

Eczematous Lamellar Disciform

Others:

Distribution of lesion: Genitocrural Axilla Inframammary

Toe web Neck Periumbilical

Generalised Others:

Colour of lesion: Reddish brown Brown

Black Hypopigmented

Extent of lesion:

Nail : Normal Subungual hyperkeratosis Onycholysis

Mucosa: Normal

Associated Skin Disorders

Other Corynebacterium causing disorders: Trichomycosis axillaries
pitted keratolysis Acne vulgaris

Fungal infections: Dermatophytosis Candidiasis

Tinea versicolor White Piedra

Other skin disorders: Vitiligo Melasma Acanthosis nigricans

Others:

INVESTIGATIONS

Blood: Hb Urine: Albumin Sugar Deposits

Blood sugar: GTT

Serum cholesterol:
Blood grouping:
Skin Surface pH:
Optional

Thyroid function tests:
ELISA:
X-ray chest: USG:

Specific

Wood's Lamp Examination:
Gram's stain smear:
Culture:
Biopsy:

TREATMENT

FOLLOW UP

KEY TO MASTER CHART

Symptoms

D	-	Duration
I	-	Itching

Sites

G	-	Groin
A	-	Axilla
I	-	Inframammary
N	-	Neck
C	-	Cubital fossa
P	-	Popliteal fossa
U	-	Periumbilical

Lesion

M	-	Macular
MP	-	Maculopapular
L	-	Lamellar
F	-	Follicular
I	-	Intertriginous
E	-	Eczematous
D	-	Disciform

Associated Skin Infections

C	-	Candidiasis
K	-	Pitted keratolysis
D	-	Dermatophytosis
TV	-	Pityriasis versicolor
T	-	Trichomycosis

Association Skin Disorders

M	-	Melasma
AN	-	Acanthosis nigricans
T	-	Traumatic Fissures
V	-	Vitiligo
A	-	Acne
S	-	Striae distensae
Ic	-	Ichthyosis
I	-	Idiopathic guttate hypomelanosis
P	-	Porokeratosis

Associated Systemic Disorders

O	-	Obesity
D	-	Diabetes mellitus
H	-	Hypothyroidism
RA	-	Rheumatoid arthritis

Others

TFT	-	Thyroid function Test
H	-	Hypothyroid picture
PCOD	-	Polycystic ovarian disease